CEC Questions and Request for Panel Participation:

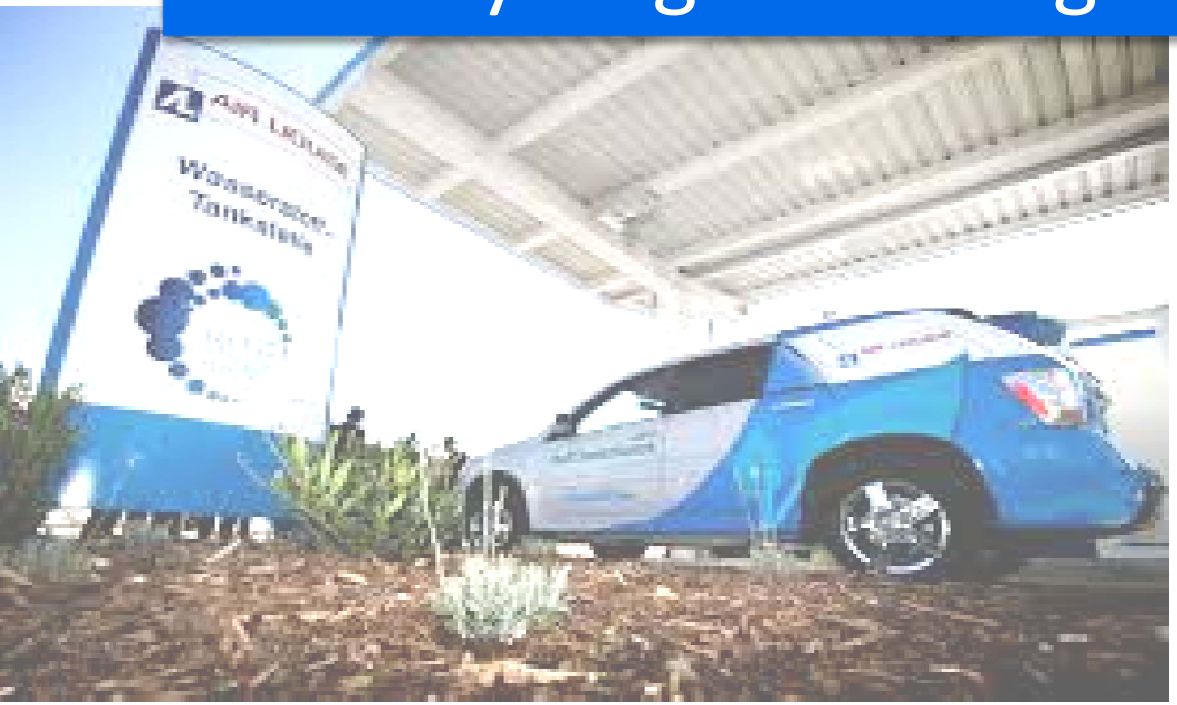
- ***Panel Q: Are there critical technology issues that need to be resolved in order to drive down station costs, or are the cost issues a function of low volume and non-standardized station designs?***

- Requested Topics:
  - plans for retail station network development.
  - Opportunities and challenges.
  - Lessons from European initiative.

BLUE HYDROGEN
Clean energy solutions

AIR LIQUIDE
Creative Oxygen

Hydrogen Fueling Opportunities



The Overall Opportunity

"Big Picture" Market Perspective

Industrial Gas Business

X 2

"If 10 per cent of cars around the world were powered by fuel cells, it would amount to **[$138B]** in sales for the industrial gas sector, which is **"twice the size of the entire global industry today"**, said Benoit Potier, Air Liquide's CEO, in an interview with the Financial Times. "

- M. Stothard,"Air Liquide looks to fuel cells to drive results" Financial Times, 5Jan2014

Global Network Planning

Think Globally, Plan Locally!

"Air Liquide has built more than 60 fuelling stations worldwide in recent years and in September it agreed with partners to expand Germany's network to 100 by 2017 and 400 by 2023" – *Financial Times 5Jan2014*

Lessons from Americas
- California retail sales experience
- California secured and sustained government funding and regulatory support
- CA serves as regional & national model
- Broader opportunities exist in Americas

Lessons from Asia
- Japanese leadership 100 stations by 2018

Lessons from Europe and Africa
- German leadership through CEP - 100 by 2017 and 400 by 2023
- Bus and car combined fueling is common

Network Planning Sources

AB 32 Compliance: Diversity of renewable feed stocks

Natural Gas C- Capture	Biomass Biogas	Solar Wind

"By 2020, Air Liquide is committed **to producing at least 50% of the hydrogen** necessary for these applications **through carbon-free processes**, by combining:

- renewable energy sources, water electrolysis and biogas reforming,
- carbon capture technologies during the hydrogen production process based on natural gas."

- Reference: Air Liquide Annual Report 2012 "Innovate"

Air Liquide's corporate goals and California State 33% renewable requirements are aligned

Network Planning Fueling Infrastructure

Flexible infrastructure products
to **supply various applications** and offer **competitive costs**

More deployments, helping **societal acceptance**

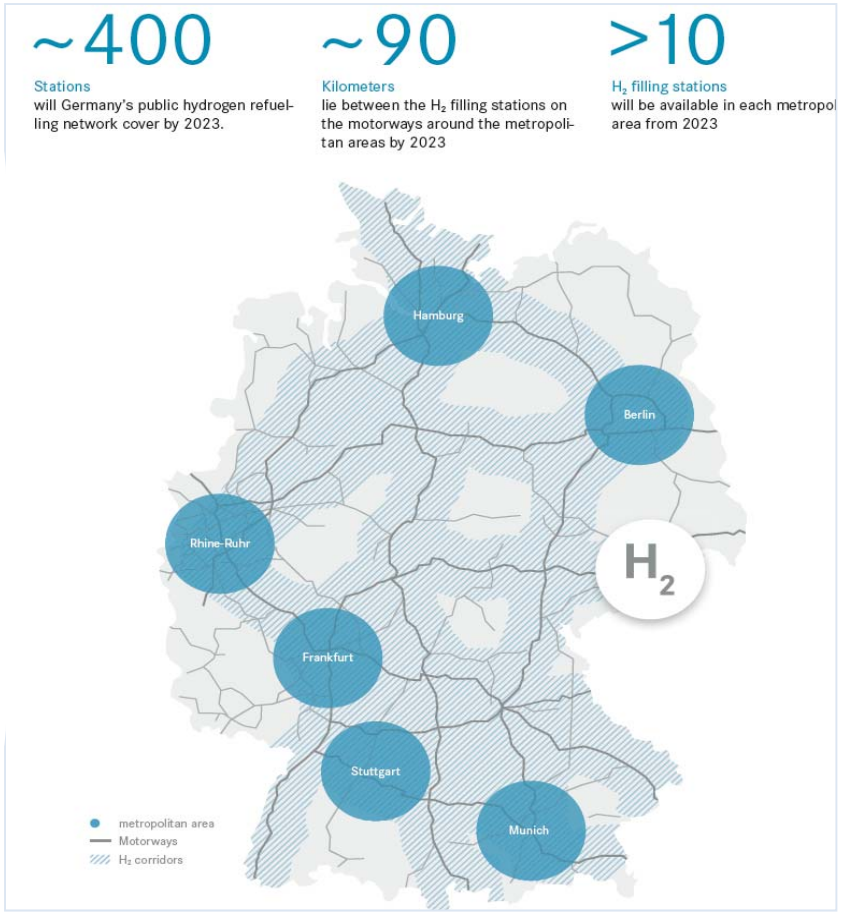
Forklifts
35 MPa
100-300 kg/day

Buses
35 MPa
100-300 kg/day

Cars
70 MPa
50-200 kg/day

German H2 Mobility

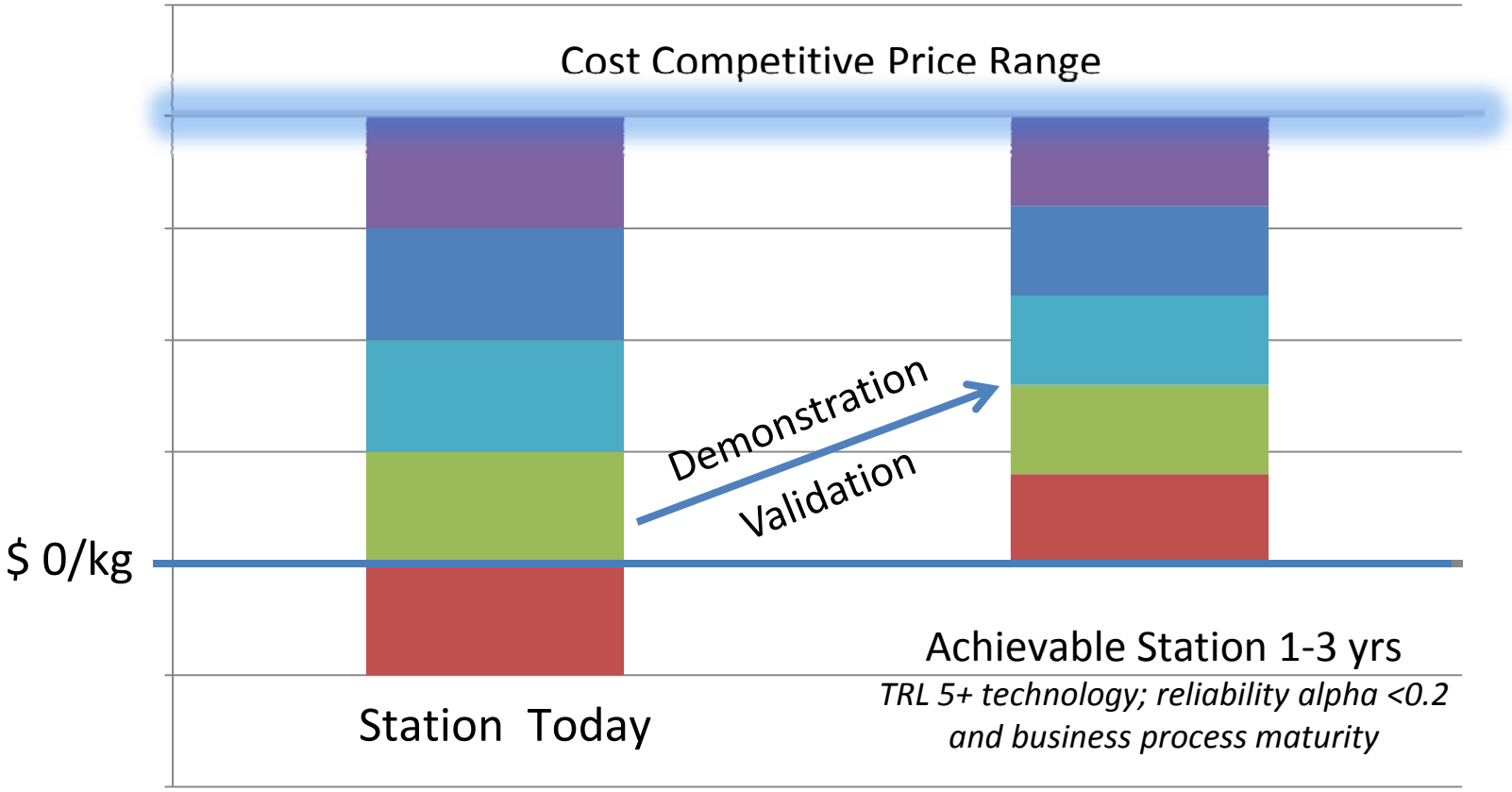
- German government Initiative gathering all stakeholders together to advance infrastructure deployment
- A common structure to “de-risk” deployment
- 100 HRS by 2018
- 200 to 400 HRS by 2023
- 250,000 FCEVs in 2023
- 350 M€ ($482M) planned



Technology vs. Scale Investment

Emerging fueling technologies and business process improvements are narrowing the gap to a more competitive market.

Need Technology Demonstration and Validation



Technology vs. Scale Investment

Regulations, Codes and Standards affects station costs and availability

Flexibility to employ new and evolving approaches to permitting stations

- Risk assessment technology development and demonstration
- Published journal articles and reports documenting the methods for use in permitting
- Risk assessment and validation of active and passive mitigation methods which demonstrate equivalency to fire barriers

Modeling and safety validation of liquid hydrogen bulk storage

- Enable risk-informed calibration of the LH2 prescriptive requirements
- Enable risk assessment and performance based approach for LH2 system permitting